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(54) Can seamer lubricating oil

(57) A lubricating composition useful for sanitary can seamers and other equipment used in the food or pharmaceutical industry, the lubricating composition comprising a major portion of a food grade lubricating oil and a minor portion of an additive package containing a food grade oxidation inhibitor, a food grade anti-wear additive and a dispersant comprising polyglyceryl 3-6 mono oleates.

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Description

This invention relates to lubricating oil compositions for automated can filling and seaming and related equipment used in food processing plants.

Can seamers are large, heavy machines that roll the lid of the can over the can body and form the seam on the can top. The can body can be made from aluminum, timplate (templated steel), composite (aluminum foil or polymer sheet or cardboard) or plastic. The can seamer typically also employs a rotary can roller and conveyor equipment. Lubricants for use in can seaming and roller or conveyor equipment should have United States Food and Drug Administration ("FDA") approval or employ FDA approved components, e.g. base oil such as white oil, polyalphaolefins, and approved additives such as anti-wear, rust inhibitors and emulsifiers, if the seamers are employed in the food or pharmaceutical industry. 21 CFR 178.3570 recites the U.S. Food and Drug Administration regulations governing lubricants with incidental food contact.

The present invention is a lubricating composition for use in can seaming and related equipment used in the food and pharmaceutical industry, said lubricating composition comprising a major portion of a food grade base oil and a minor portion of an additive comprising polyglyceryl 3-6 mono-oleate.

The food grade lubricating base oil may be selected from 10 to 5000 cSt @ 40°C food grade natural or synthetic base stock oil, preferably 30 to 300 cSt @ 40°C food grade natural or synthetic oil and mixtures thereof.

Natural base oil is identified as white oil, a colorless, transparent liquid mixture of paraffins. The white oil is produced by the distillation of higher boiling petroleum fractions (330-390°C) which fraction is extracted to remove aromatics, dewaxed, hydrotreated to remove sulfur and nitrogen compounds and olefins. Treatment may also include purification using sulfuric acid, caustic soda, decalcination by carbon filtration, etc. The production of white oils is well known in the art.

Synthetic base stocks suitable for use include food grade polyalphaolefins and stocks useful as thickeners including polyisobutylenes and polybutenes as approved in 21 CFR 178.3570 cited above.

The food grade lubricating composition preferably comprises 94 to 99 wt%, more preferably 96 to 98 wt%, of the said base oil based on the weight of the lubricating composition.

The composition also contains a minor portion of polyglyceryl 3-6 mono-oleate, preferably triglyceryl mono-oleate, tetraglyceryl mono-oleate, hexaglyceryl mono-oleate or mixtures thereof, more preferably tetraglyceryl mono-oleate also known as polyglyceryl-4-oleate, the oleic acidmonoester of a glycerin polymer containing an average 4 glycerin units.

The polyglyceryl mono-oleate is preferably used in an amount in the range 1 to 6 wt%, more preferably 2 to 4 wt%, based on the weight of the lubricating composition.

The lubricating composition preferably has a final formulated viscosity in the range 20 cSt @ 40°C to 350 cSt @ 40°C. The final product viscosity can be attained by using a single base oil which itself possesses the viscosity of the final product or by using a number of base oils from those recited above and mixing them together to produce a blend having the desired viscosity or by addition of an FDA approved thickener stock material such as polybutene or polyisobutylene.

The formulated oil may contain other additives, including rust inhibitors/anti wear agents, in an amount in the range 0.01 to 2.0 wt%, preferably 0.1 to 0.5 wt%, anti oxidants in an amount in the range 0.01 to 1.0 wt%, preferably 0.1 to 0.5 wt%. These additional additives must likewise be FDA approved. Examples of FDA approved materials are food grade butylated hydroxy toluene BHT (anti oxidant) and the salt of mixed hexyl acid phosphate plus di (C_{11}-C_{14}) branched alkyl amines (as rust inhibitor/anti wear agents). A more complete listing of other FDA approved materials suitable for use as antioxidants, rust protective compounds and anti-wear additives appears in 21 CFR 178.3570.

It is highly desirable that lubricating compositions used in can seaming and other related food processing equipment meet a number of performance specifications, including a flash point of 200°C minimum, a viscosity at 40°C preferably in the range 140-160, a viscosity index of 95 minimum, dispersency/emulsibility under the ASTM D1401 2 minute mix test @ 80°C expressed as oil/water/emulsion (time) of 0-20-60 (60) based on 80 unit, maximum. There must also be no rust observable on the spindle under the ASTM D665B test using synthetic salt water and the oxidation stability, as determined by the Rotary Bomb Oxidation Test should be 75 minute minimum. The can seamer lubricant should preferably be both FDA acceptable for food plants and have USDA H-1 approval.

The lubricating composition of the present invention can meet all these criterion.

The invention is further elucidated in the following non-limiting examples and comparisons.

EXAMPLES

EXAMPLE 1

A can seamer lubricant was formulated comprising 88.6 wt% United States Pharmaceutical Grade ("USP") mineral

oil 600 (white oil), 9 wt% of polyisobutylene thickener (average molecular weight about 1340), 2 wt% tetraglyceryl mono-oleate (emulsifier), 0.2 wt% of a salt of mixed hexyl acid phosphate and di (C_{11}-C_{14}) branched alkyl amines (rust inhibitor/anti wear agents) and 0.2 wt% food grade BHT anti oxidant. This formulation possessed a flash point of greater than 200°C, a viscosity at 40°C of 150 cSt, a viscosity index of 145, D1401, 2 minute mix emulsion characteristics, reported as oil-water-emulsion (time) test run at 80°C of 0-15-65 (60). It passed the ASTM D665A and ASTM D665B rust tests, the Falex Wear ASTM D2870 (modified) wear test and the Rotary Bomb oxidation test with a reading of 75 minutes.

This lubricant has very good water emulsifying and dispersing properties and oxidation resistance, similar to the aviation oils currently used as can seamer lubricants but superior rust and wear protection than the aviation oils, e.g., Shell's Aeroshell W oils and Exxon Aviation EE oils, both of which failed both the ASTM D665A and the ASTM D665B (using synthetic salt water) Rust Tests and the ASTM D2670 (modified) Falex Wear test when tested under the same conditions as the present formulation. More importantly, the formulation of the present invention is prepared using FDA approved components and therefore is FDA acceptable for food plant and USDA H-1 approvable.

COMPARATIVE EXAMPLE 1

A number of other esters and acids were evaluated as water emulsifying/dispersing agents in comparison to poly glyceryl mono oleate. These ester and acids are recited below, with a comment on the observed performances. These materials were not tested in a fully formulated lubricant but only in combination with USP mineral oil base stock. The additives were evaluated at treat rate of 2%, then 1% unless otherwise indicated. A single observation comment is provided for all concentrations tested.

Sorbitan mono-oleate - treat rates 2 to 4% - additive did emulsify water to some degree but only to half as much as aviation oils. Left droplets of oil that condensed after time to separate and drop out. Yellow color deemed unacceptable.

Polyoxyethylene (20) sorbitan mono-laurate-oil-insoluble, haze.

Polyethylene (4) sorbitan mono-laurate-oil-insoluble, haze.

Polyoxyethylene (20) sorbitan monopolmilite-oil-insoluble, haze.

Polyoxyethylene (20) sorbitan monostearate-oil-insoluble, haze.

Polyoxyethylene (20) sorbitan mono-oleate-yellow color to oil, -oil insoluble, haze.

Polyoxyethylene (5) sorbitan mono-oleate-yellow color to oil, essentially oil insoluble, haze.

Polyoxyethylene (20) sorbitan tuoleate - oil insoluble, haze.

Sorbitan trioleate - soluble, not effective as emulsifier/dispersing agent.

Polyoxyethylene sorbitol hexoleate - hazy, additive crystallized as rated - no effect in water shedding.

Sorbiton monostearate - insoluble.

Glycerol monostearate - insoluble.

Phosphated mono and diglycerides-reacted to form sodium salt, insoluble. Polyethylene glycerol mono-oleate - insoluble.

Olive oil (~80% oleic acid) insoluble.

COMPARATIVE EXAMPLE 2

Glyceryl mono oleate at a number of different treat levels was evaluated for emulsification/dispersing performance and compared with aviation oils (Shell Aeroshell W100 and Exxon Aviation EE) as well as Atmos 300 (a blend of mono and diglycerides and propylene glycol), and polyglyceryl (4) mono oleates. The test was ASTM D1401 modified to two

minutes mixing time. The results are presented below.

	Oil	/ Water	/ Emulsion
1% glyceryl mono oleate *	2	0	78
2% glyceryl mono oleate *	3	0	77
5% glyceryl mono oleate *	2	0	78
2% polyglyceryl (4) mono oleate	0	15	65
2% Atmos 300	13	6	61
Shell (Aeroshell W100)	0	20	60
Exxon Aviation EE	0	13	67

* oil portion appeared clear upon blending but glyceryl mono-oleate came out of solution after 48 hours.

In separate runs 0.5% glyceryl mono oleate was tried but it came out of solution after 48 hours. Polyglyceryl (4) mono oleate was found to be soluble at up to 5% loading after 240 hours.

It was unexpected that polyglyceryl mono oleates would have the right balance of water solubility and oil solubility to match the aviation oils for emulsibility/dispersancy. The polyglyceryl mono oleate is approved for use by FDA (para. 21 CFR 178.354) and should be USDA H-1 approvable.

Claims

1. A lubricating oil composition useful for can seamer and related equipment used in the food and pharmaceutical industry comprising a major portion of a food grade base oil and a minor portion of polyglyceryl 3-6 mono oleate.

2. The composition of claim 1 wherein the food grade base oil is a natural or synthetic lubricating base oil or mixture thereof having a viscosity in the range 10 to 5000 cSt at 40°C.

3. The composition of claim 1 wherein the food grade base oil is selected from white oil, polyalphaolefins, polybutenes, polyisobutylenes and mixtures thereof.

4. The composition of any preceding claim wherein the polyglyceryl 3-6 mono oleate is polyglyceryl-4-oleate.

5. The composition of any preceding claim wherein the food grade base oil comprises 94 to 99 wt% of the composition and the polyglyceryl mono oleate comprises 1 to 6 wt% of the composition.

6. The composition of any preceding claim having a final formulated viscosity in the range 20 to 350 cSt at 40°C, a flash point of 200°C minimum, a viscosity index of 95 minimum, oxidation stability as determined by the Rotary Bomb Oxidation test of 75 minutes minimum, dispersancy/ emulsibility under the ASTM D1401 test (modified to 2 minutes mixing) at 80°C expressed as oil/water/emulsion (time) of 0-20-60 (60) based on 80 units, maximum, pass the ASTM D665B rust test.

7. The composition of any preceding claim further containing U.S. Food and Drug Administration acceptable rust inhibitors/anti wear agents and anti-oxidants, as defined in FDA Regulation 21 CFR 178.3570.

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EUROPEAN SEARCH REPORT

Application Number
EP 96 30 2145

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	US-A-2 672 444 (J.I.WATSON) 16 March 1954 * column 4, line 69 - column 5, line 42 * * column 3; table 1 *	1-7	C10M129/76 C10M169/04 //(C10M169/04, 101:02,107:02, 107:08, 129:76), C10N40:00
Y	US-A-5 102 567 (L.R.WOLF) * column 3, line 4 - line 62 * * column 10 - column 11; table 1 *	1-7	
Y	EP-A-0 612 833 (ASAHI DENKA K.K.K.) * page 2, line 49 - line 51 * * page 6, line 1 - line 20 * * page 3, line 40 - line 52 *	1,4	
A	US-A-3 637 774 (V.K.BABAYAN) 25 January 1972 * column 10, line 32 - line 34 * * column 8, line 18 - line 25 *	1	
A	EP-A-0 625 563 (CALGENE CHEMICAL INC.) * page 3, line 24 - line 57 *	1,4	
A	EP-A-0 556 995 (CASTROL LTD) * column 1, line 14 - line 34 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) C10M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 July 1996	Rotsaert, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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